IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	**10/658,530**

Confirmation No. 1958

Applicant	:	K. IWAMITSU et al.
Filed	:	September 10, 2003
Title	:	STORAGE SYSTEM AND A METHOD FOR DIAGNOSING FAILURE OF THE STORAGE SYSTEM
TC/AU	:	2184
Examiner	:	TBD
Docket No.	:	500.43115X00
Customer No.:		24956

PETITION TO MAKE SPECIAL
UNDER 37 CFR §1.102(d) (MPEP §708.02(VIII))

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The Applicants petition the Commissioner to make the above-identified application special in accordance with 37 CFR §1.102(d). In support of this Petition, pursuant to MPEP § 708.02(VIII), Applicants state the following.

(A)   REQUIRED FEE

This Petition is accompanied by the fee set forth in 37 CFR § 1.117(h). A Credit Card Payment Form in the amount of $130 accompanies this Petition in satisfaction of the fee. The Commissioner is hereby authorized to charge any

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

additional payment due, or to credit any overpayment, to Deposit Account No. 50-
1417.

(B) ALL CLAIMS ARE DIRECTED TO A SINGLE INVENTION

Following the Preliminary Amendments filed on March 4 and May 20, 2005,
claims 21-42 are pending in the application. All the pending claims of the application
are directed to a single invention. If the Office determines that all claims in the
application are not directed to a single invention, Applicant will make election without
traverse as a prerequisite to the grant of special status.

The claimed invention, as set forth in independent claims 21 and 38-42, is
generally directed to a storage system able to detect a faulty part and recover from a
malfunction without stopping normal processing. Under independent claim 21, the
invention is a storage system, comprising: a plurality of controllers controlling to
transfer data to a plurality of storage regions; a plurality of data lines coupled to said
controllers and being used to transfer data from said controllers to said storage
regions; a plurality of disk drive units coupled to said data lines and having said
storage regions; and a display coupled to said controllers and displaying information
related to said storage system; wherein a first controller of said controllers transfers
data on a first data line of said plurality of data lines and transfers a command on a
second data line of said plurality of data lines, if said storage system has a failure
after transferring data on said second data line, wherein said command is used to

2

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

obtain an area of said failure, and wherein said display displays said area of said failure.

Additionally, as set forth in independent claim 38, the invention is a storage system, comprising: one or more controllers controlling to transfer data to a plurality of storage regions; a plurality of data lines coupled to said controllers and being used to transfer data from said controllers to said storage regions; a plurality of disk drive units coupled to said data lines and having said storage regions; and a display coupled said controller and displaying information related to said storage system; wherein a first controller of said controllers transfers a command on a second data line of said plurality of data lines and transfers data on a first data line of said plurality of data lines, if said storage system has a failure after transferring data on said second data line, wherein said command travels around on said second data line, and wherein said display displays an area of said failure.

Also, as set forth in independent claim 39, the invention is a storage system, comprising: one or more controllers controlling to transfer data to a plurality of storage regions; a plurality of data lines coupled to said controllers and being used to transfer data from said controllers to said storage regions; a plurality of disk drive units coupled to said data lines and having said storage regions; and a display coupled said controller and displaying information related to said storage system; wherein a first controller of said controllers relays data on a first data line of said plurality of data lines and relays a command on a second data line of said plurality of data lines, if said storage system has a failure after relaying data on said second

3

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

data line, wherein said command is used to initialize said second data line, wherein said display displays an area of said failure.

Furthermore, as set forth in independent claim 40, the invention is a storage system, comprising: a plurality of controllers controlling to transfer data to a plurality of storage regions; a plurality of data lines coupled to said controllers and being used to transfer data from said controllers to said storage regions; and a plurality of disk drive units coupled to said data lines and having said storage regions; wherein a first controller of said controllers transfers a command on a second data line of said plurality of data lines and transfers data on a first data line of said plurality of data lines, if said storage system has a failure after transferring data on said second data line, wherein said command is used to obtain an area of said failure.

In addition, as set forth in independent claim 41, the invention is a storage system, comprising: a plurality of controllers controlling to transfer data to a plurality of storage regions; a plurality of data lines coupled to said controllers and being used to transfer data from said controllers to said storage regions; a plurality of disk drive units coupled to said data lines and having said storage regions; and a display coupled said controller and displaying information related to said storage system; wherein data are relayed by a first controller of said controllers on a first data line of said plurality of data lines and a command is relayed by the first controller on a second data line of said plurality of data lines, if said storage system has a failure after relaying data on said second data line, wherein said command is used to obtain an area of said failure, and wherein said display displays said area of said failure.

4

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

Finally, as set forth in independent claim 42, the invention is a storage system, comprising: one or more controllers controlling to transfer data to a plurality of storage regions; a plurality of data lines coupled to said controllers and being used to transfer data from said controllers to said storage regions; a plurality of disk drive units coupled to said data lines and having said storage regions; and a display coupled to said controller and displaying information related to said storage system; wherein said storage system performs the steps of: transferring data on a first data line of said plurality of data lines coupled to a first controller of said controllers, having a failure between said first data line and one of said disk drives after said transferring data on said first data line, transferring a command on said first data line by said first controller and transferring data on a second data line of said plurality of data lines by said first controller after having said failure, said command being used to obtain a position of said failure, and displaying said position of said failure on said display.

(C)   PRE-EXAMINATION SEARCH

A careful and thorough pre-examination search has been conducted, directed to the invention as claimed. The pre-examination search was conducted in the following US Manual of Classification areas:

Class	Subclass
714	2, 6, 7, 724, 795

Furthermore a keyword search was conducted on the USPTO's EAST database, including the US patent database, the published patent applications

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

database, and the European and Japanese patent abstract databases. Additionally,

a search for foreign art was conducted using the European Patent Office's

ESPACENET database.

(D) DOCUMENTS DEVELOPED BY THE PRE-EXAMINATION SEARCH AND OTHER ART OF RECORD IN THE APPLICATION

The documents located by the pre-examination search are listed immediately

below. These documents were made of record in the present application by the

Information Disclosure Statement filed March 10, 2005.

Document No.	Inventor
US 5392302	Kemp, Paul W. et al.
US 5611069	Matoba, Tatsuo
US 6643795	Sicola, Stephen J. et al.
JP 357101950A	Nihei, Toshihiko et al.
JP 358114125A	Kawashima, Tadashi

Additionally, the following documents were made of record in the present

application by the Information Disclosure Statement filed May 17, 2005.

Document No.	Inventor
US 6219753	Richardson
US 6678839	Mori
US 6795934	Nagata et al.
US 20020019897	Cruyningen

Additionally, the following document was made of record in the present

application by the Information Disclosure Statement filed March 11, 2005.

Document No.	Inventor
US 20020002440	Sakai, Toshihiro

Additionally, the following document was made of record in the present

application by the Information Disclosure Statement filed January 27, 2005.

Document No.	**Inventor**
JP 2002007077	Sakai, Toshihiro

Additionally, the following documents were made of record in the present

application by the Information Disclosure Statement filed January 12, 2005.

Document No.	**Inventor**
US 6128750	Espy et al.
US 6598174	Parks et al.
US 6725293	Nakayama et al.
US 20030135872	Matsunami et al.
US 20030188233	Lubbers et al.

Because all of the above-listed documents are already of record in the present

application, in accordance with MPEP § 708.02(VIII)(D), additional copies of these

documents have not been submitted with this Petition.

(E)   DETAILED DISCUSSION OF THE REFERENCES

Those of the above-listed documents deemed to be most closely-related to

the subject matter encompassed by the present claims are discussed below in

section 2, pointing out, with the particularity required by 37 CFR 1.111 (b) and (c),

how the claimed present subject matter is patentable over the teachings of these

documents.

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

1. Discussion of the Invention

The present invention is a storage system having one or more controllers coupled to redundant data line loops so that if a failure occurs on one of the data lines controlled by one of the controllers, data still may be transferred on another data line by that controller. Additionally, following a failure on the data line, the same controller is able to transfer a command on the failed data line to obtain the position or area of the failure, or to initialize the data line. (See, independent claims 21 and 38-42.) For example, as recited in claim 21, a first controller of the controllers transfers data on a first data line of the plurality of data lines and transfers a command on a second data line if the storage system has a failure after transferring data on the second data line, wherein the command is used to obtain an area of the failure. Under an additional aspect, the area of the failure may be displayed on a display coupled to the controllers. (See, independent claims 21, 38, 39, 41 and 42.) Thus, the present invention provides for a relation among the identification of a position of a failure, a display operation, and a reading and writing operation. As detailed below, none of the art currently of record teaches or fairly suggests these features of the present invention.

2. Discussion of the References Believed to be Most Closely Related

The patent to Mori, US 6678839, shows a system having a looped interface and a trouble-shooting function. Plural devices may be connected to the looped interface, and port bypass circuits are provided to enable the devices to be detached

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

from the loop. A loop fault is analyzed using a port bypass circuit, and a faulty location that is the cause of a loop fault can be narrowed. (See, e.g., column 1, line 56, through column 2, line 37, and column 5, line 49, through column 7, line 38.) However, Mori does not disclose a plurality of data lines, wherein data is transferred or relayed on a first data line if the storage system has a failure while transferring data on a second data line. Thus, Mori does not teach a storage system in which a controller transfers/relays a command on a second data line of a plurality of data lines to obtain the position of the failure on a second data line, and transfers/relays data on a first data line, if the storage system has a failure after transferring/relaying data on the second data line, as set forth in claims 21, 40, 41, and 42. Mori also does not teach a storage system in which the command travels around the second data line or is used to initialize the second data line, and a display displays an area of the failure, as recited in claims 38 and 39.

The patent to Nagata et al., US 6795934, teaches a storage system having multiple controllers and two FC loops connected to each of the controllers. Multiple drives are connected to the multiple controllers through the FC loops, and through port bypass circuits (PBCs), so that the multiple drives are shared by the multiple controllers. If a drive or controller is failing, the PBCs may be used to disconnect the drive or controller by switching one or more adjacent PBCs. If one of the loops is failing, the controller that has been using that loop is forced to use the other loop to recover from the failure. In this case, since both controllers use the same loop, the

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

bandwidth for the loop is reduced to half the normal amount and data transfer performance is decreased. (See, e.g., column 1, line 46, through column 3, line 58, and column 7, line 49, through column 9, line 33.) Thus, in Nagata et al., a command is not circulated around the failed loop, while data is transferred on an alternate loop. According Nagata et al. do not teach a storage system in which a controller transfers/relays a command on a second data line of a plurality of data lines to obtain the position of the failure on a second data line, and transfers/relays data on a first data line, if the storage system has a failure after transferring/relaying data on the second data line, as set forth in claims 21, 40, 41, and 42. Further, Nagata et al. do not teach a storage system in which the command travels around the second data line or is used to initialize the second data line, and a display displays an area of the failure, as recited in claims 38 and 39.

The Japanese patent to Sakai, JP 2002007077 (corresponding to US published patent application US 20020002440), shows a disk array apparatus that includes a pair of controllers, each controlling a loop for the disk array. The system includes a loop monitoring means such that if any abnormality is detected in a specific loop, a loop controller suspends execution of any instruction in the specific loop and substitutes another loop for execution of the instruction (see, e.g., paragraphs 9-28). However, Sakai is different both in structure and in function from the present invention. In Sakai, when a failure is detected in a loop controlled by one of the disk control units 71, 72, the instruction is processed using the loop controlled

10

by the other disk control unit 71, 72. Thus, Sakai does not provide a controller per a

plurality of loops connected to the same disk drive, since a first control unit and a

second control unit are necessary for the system to function, and the second control

unit takes over the data processing functions of the first control unit. (See, e.g.,

FIGS. 1-4 and paragraphs 35-41 and 49-58.) Upon detecting a failure in a loop

controlled by the first control unit 71, 72, a request is made to the second control unit

71, 72 controlling the other loop to perform all items of disk processing. Also, the

instruction that was being processed during detection of the failure is re-sent to the

other control unit (paragraphs 50-53). This frees the first control unit to issue a group

of commands for loop diagnosis, whereby the disk control unit identifies a disk

suspected of causing the failure and severs the disk from the failed loop (paragraphs

54-56). Accordingly, Sakai differs from the claimed invention in that the controller

coupled to the failed loop does not continue normal processing, but is devoted solely

to failure analysis of the failed loop, whereas in the present invention, the controller

that was controlling the transfer of data over the failed loop is able to perform both

normal processing through an alternate redundant loop and failure analysis of the

failed loop (see, e.g., FIG. 5 of the present application and associated discussion

beginning at page 12 of the specification). Accordingly, the present invention is able

to function even with a single disk controller, whereas Sakai is not. Thus, Sakai does

not teach a storage system in which a controller transfers/relays a command on a

second data line of a plurality of data lines to obtain the position of the failure on a

second data line, and transfers/relays data on a first data line, if the storage system

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

has a failure after transferring/relaying data on the second data line, as set forth in claims 21, 40, 41, and 42. Nor does Sakai teach a storage system in which the command travels around the second data line or is used to initialize the second data line, and a display displays an area of the failure, as recited in claims 38 and 39.

The patent to Sicola, US 6643795, shows a controller-based bi-directional remote copy system with storage site failover capability. The system provides a completely redundant configuration including dual Fibre Channel fabric links interconnecting each of the controllers of two data storage sites, wherein each site comprises a host computer and associated data storage array, with redundant array controllers and adapters. Each array controller is capable of performing all of the data replication functions, and each host "sees" remote data as if it were local. In a situation where a first controller of a pair fails, the second controller of the pair initiates a failover operation, but use of redundant loops in the storage arrays is not disclosed. (See, e.g., Abstract, figures 1-16, column 3 lines 15-67, column 5 lines 1-15, and column 11, lines 28-35.) Sicola also teaches failover operations for failures of the links, but these links are between storage controllers (see column 14, lines 9-48) and do not connect controllers to disk drive units, as set forth in the claims of the present invention. Thus, Sicola does not teach a storage system in which a controller transfers/relays a command on a second data line of a plurality of data lines to obtain the position of the failure on a second data line, and transfers/relays data on a first data line, if the storage system has a failure after transferring/relaying

12

data on the second data line, combined with the other limitations of claims 21, 40,

41, and 42. Further, Sicola does not teach a storage system in which the command

travels around the second data line or is used to initialize the second data line, and a

display displays an area of the failure, as recited in claims 38 and 39.

The patent to Espy, US 6128750, shows a recovery method in a data storage

system in which a pair of fail-over switches may route requests to either of two

communication loops coupled to plural disk storage devices and a pair of storage

controllers. Upon detection of a failure in one loop, a first storage controller using

that loop may request access to the other loop. Thus, the first controller may be

switched into connection with the remaining operable loop, and share that loop with

the second controller, thereby enabling both controllers to continue to operate

despite loss of one of the loops. (See, e.g., FIG. 1 and column 1, line 53, through

column 3, line 2.) Thus, while Espy teaches switching to a second loop upon failure

in a first, Espy does not transfer a command around the original loop or perform a

diagnosis to locate or display the position of the failure. Thus, Espy does not teach a

storage system in which a controller transfers/relays a command on a second data

line of a plurality of data lines to obtain the position of the failure on a second data

line, and transfers/relays data on a first data line, if the storage system has a failure

after transferring/relaying data on the second data line, as set forth in claims 21, 40,

41, and 42. Nor does Espy teach a storage system in which the command travels

Appl. No. 10/658,530
Petition to Make Special

Docket No. 500.43115X00

around the second data line or is used to initialize the second data line, and a display

displays an area of the failure, as recited in claims 38 and 39.

3.   Remaining References

The remaining references of record in the application are deemed to not be

most-closely related to the present invention, and/or were provided as background

information, and also do not show or suggest the present invention. For example,

Richardson (US 6219753), Cruyningen (US 20020019897), Kemp et al. (US

5392302), Matoba (US 5611069), Nihei JP357101950A, Kawashima

(JP358114125A), Parks et al. (US 6598174), Nakayama et al. (US 6725293),

Matsunami et al. (US 20030135872), and Lubbers et al. (US20030188233) all fail to

disclose a storage system in which a controller transfers/relays a command on a

second data line of a plurality of data lines and transfers/relays data on a first data

line, if the storage system has a failure after transferring/relaying data on the second

data line, as recited in claims 21 and 38-42.

(F)   CONCLUSION

Thus, from the foregoing, it is apparent that none of the above-listed

documents teach a storage device in which a controller transfers a command on a

second data line, and also transfers data on a first data line, if the storage system

has a failure after transferring data on the second data line. Nor do the above-listed

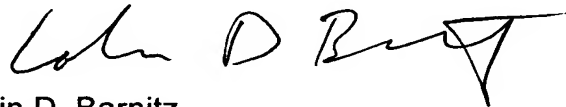documents show or suggest using the command to obtain an area of a failure or for

displaying an area of the failure. Accordingly, claims 21 and 38-42 are patentable over the above-listed documents.

The Applicants submit that the foregoing discussion demonstrates the patentability of the independent claims over the closest-known prior art, taken either singly, or in combination. The remaining claims depend from the independent claims, claim additional features of the invention, and are patentable at least because they depend from allowable base claims. Accordingly, the requirements of 37 CFR §1.102(d) having been satisfied, the Applicants request that this Petition to Make Special be granted and that the application be examined according to prescribed procedures set forth in MPEP §708.02 (VIII).

The Applicants prepared this Petition in order to satisfy the requirements of 37 C.F.R. §1.102(d) and MPEP §708.02 (VIII). The pre-examination search required by these sections was "directed to the invention as claimed in the application for which special status is requested." MPEP §708.02 (VIII). The search performed in support of this Petition is believed to be in full compliance with the requirements of MPEP §708.02 (VIII); however, Applicants make no representation that the search covered every conceivable search area that might contain relevant prior art. It is always possible that prior art of greater relevance to the claims may exist. The Applicants urge the Examiner to conduct his or her own complete search of the prior art, and to thoroughly examine this application in view of the prior art cited above and any other prior art that may be located by the Examiner's independent search.

Further, while the Applicants have identified and discussed certain portions of

each cited reference in order to satisfy the requirement for a "detailed discussion of

the references, which discussion points out, with the particularly required by 37

C.F.R. §1.111(b) and (c), how the claimed subject matter is patentable over the

references" (MPEP §708.02(VIII)), the Examiner should not limit review of these

documents to the identified portions, but rather is urged to review and consider the

entirety of each reference.

Respectfully submitted,

Colin D. Barnitz
Registration No. 35061
Attorney for Applicants

MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C.
1800 Diagonal Rd., Suite 370
Alexandria, Virginia 22314
(703) 684-1120
Date: May 23, 2005